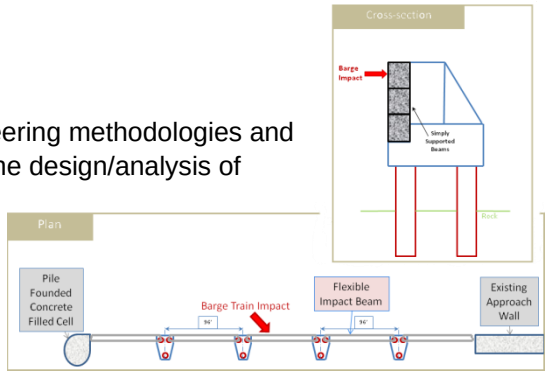
Flexible Approach Walls

Problem

More than 50% of the Corps locks and their approach walls have continued past their economic lifetimes. As these structures wear, they need to be retrofitted, replaced, or upgraded with a lock extension. Energy absorbing flexible approach wall structural systems are being considered. These next generation flexible structures feature reduced replacement costs as well as providing additional protection for barge train traffic and their personnel. Innovative flexible structures would provide cost savings by taking advantage of in-the-wet construction. Flexible structures would help to protect barge train traffic by "flexing" to absorb energy from impacts in order to maintain barge train integrity, and reduce the possibility of broken lashings and runaway barges. These structures will also be *efficiently* resilient under design impact loadings, with less costly repairs.

Approach



The primary objective of this project is to develop simplified engineering methodologies and corresponding PC-based software for use by Corps engineers in the design/analysis of energy absorbing, flexible approach wall structural systems. Specific focus will be applied to approach wall systems containing vertical and batter pile groups for barge impact loading. Pile group response effects define the performance criteria for the design load cases, and proper accounting of these effects is an important part of the engineering methodology development process. A secondary objective is to facilitate energy absorbing, flexible designs and flexible structural components that can make use of in-the-wet construction, thereby affecting a cost savings.

Products

Engineering methodology and a suite of supporting software (Impact_Force , Impact_Deck, and Impact_Beam) for the dynamic structural analysis and design of next-generation, pile-founded, flexible, energy-absorbing approach wall systems are being developed. These tools will facilitate the investigation of various structural configurations of flexible walls during the design process and quantify the resilience and toughness of these structures. The engineering software CPGA-R has been developed to support risk and reliability engineering for major rehabilitation studies, and is available in CASE.

Benefits

Flexible approach walls will provide cost savings by accommodating in-the-wet construction with the use of lighter and smaller structural features. Cost savings will also be realized by avoiding runaway barges in gates. This is done by preserving barge train integrity through the absorption of barge train impact energy by the potential energy of the flexible structure. Flexibility allows the approach wall to absorb the kinetic energy of a fully-ballasted barge train (normal to the wall) with the potential energy through deformation of the deformable piles and superstructure of the approach wall. Key energy absorbing structural system features are flexible impact beams and flexible pile group systems.

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